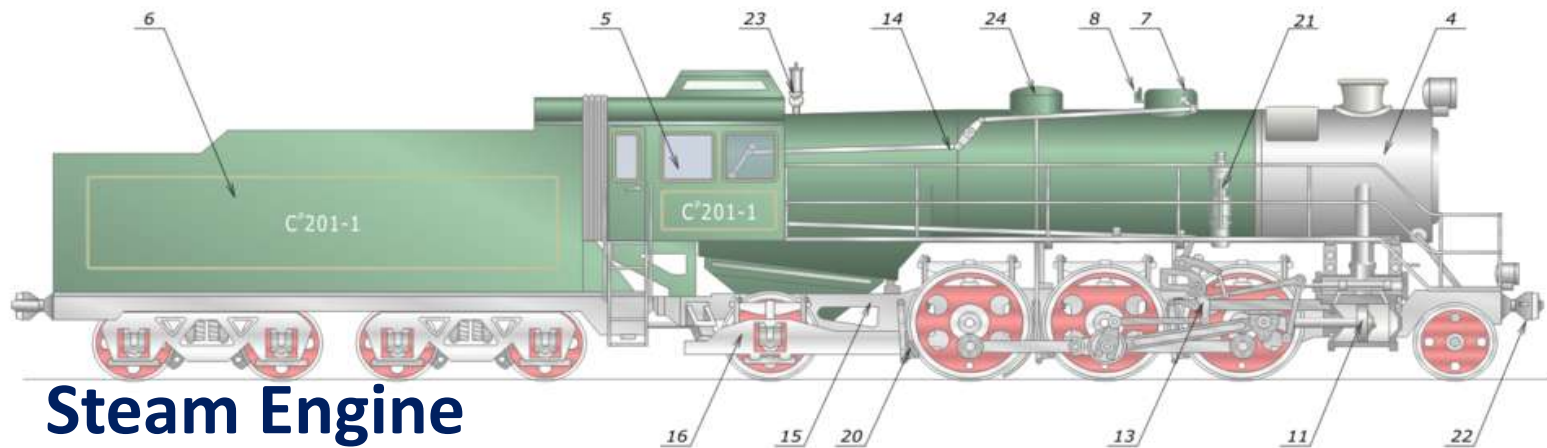


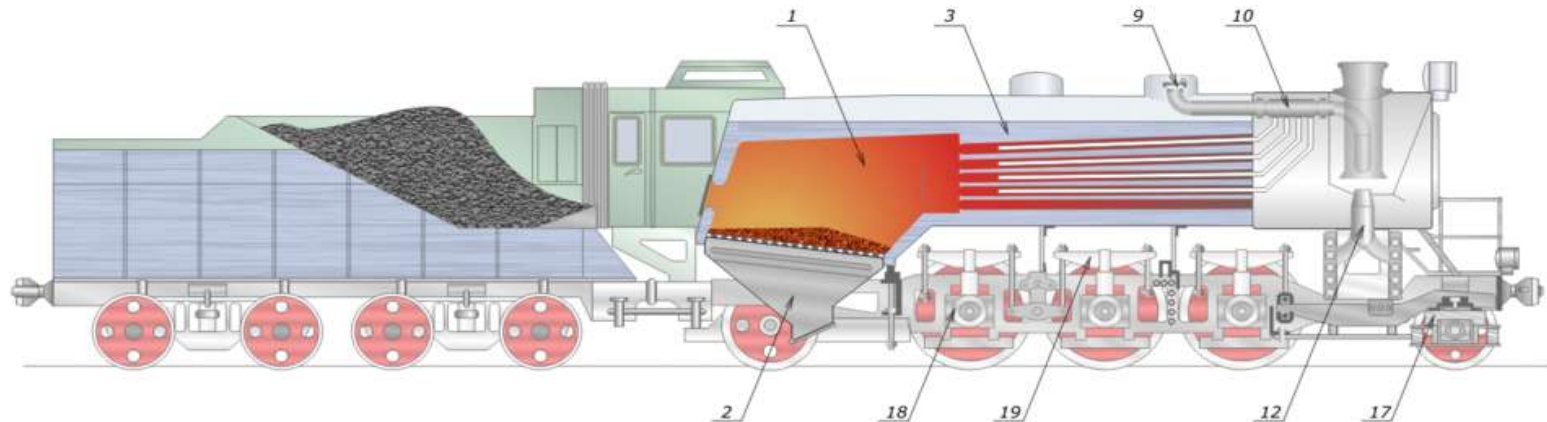
Steam Locomotives

Heritage Engines

Steam Locomotive



Steam Engine

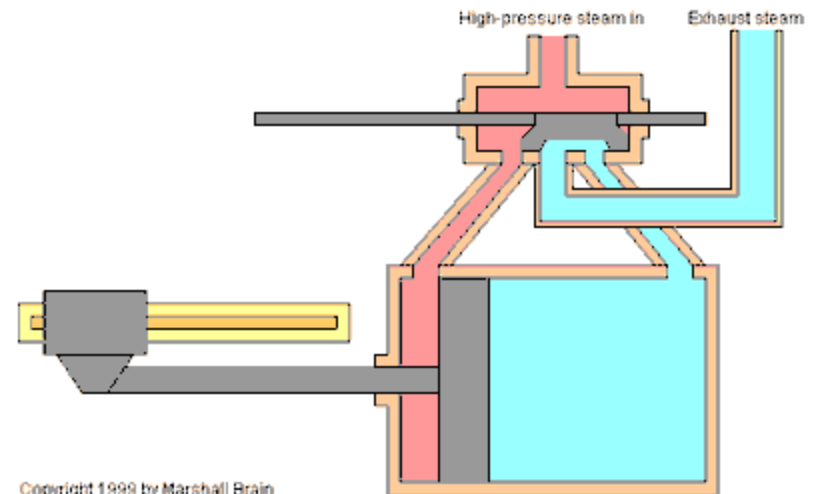
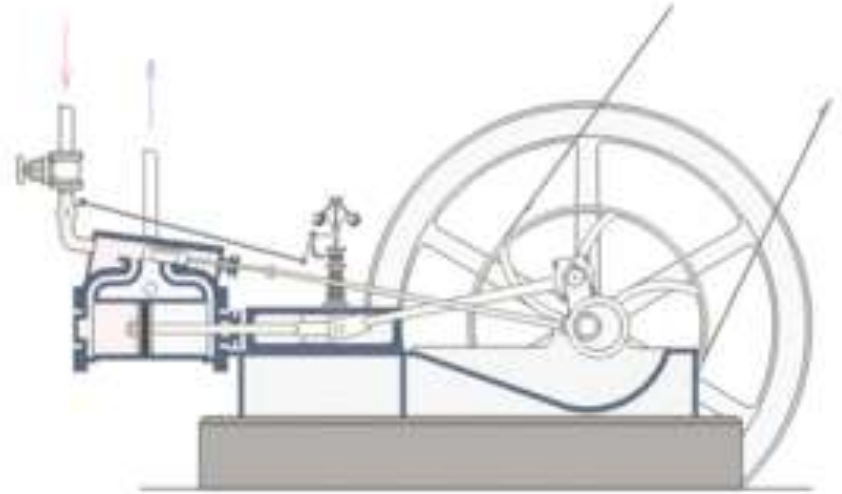


1. Firebox 2. Ashpan 3. Water (Inside the Boiler) 4. Smoke box 5. Cab 6. Tender 7. Steam Dome 8. Safety Valve 9. Regulator Valve 10. Super heater Header in smoke box 11. Piston 12. Blastpipe 13. Valve Gear 14. Regulator Rod 15. Drive Frame 16. Rear Pony Truck 17. Front Pony Truck 18. Bearing and Axle box 19. Leaf Spring 20. Brake shoe 21. Air brake pump 22. (Front) Centre Coupler, 23. Whistle 24. Sand box.



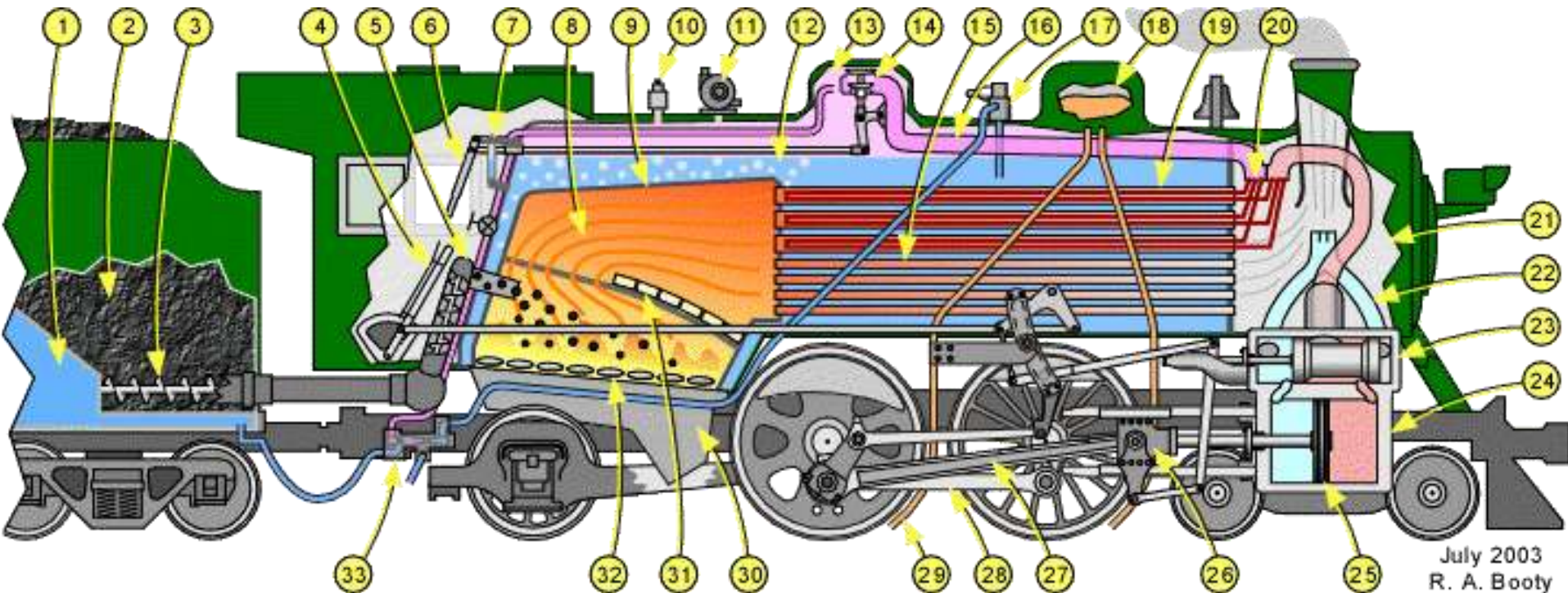
Steam Engines

1. Reciprocating positive displacement machine
2. External combustion engine only {furnace in boiler}
3. Lumped coal fuelled horizontal fire tube boilers
4. Exhaust Steam compression by spool valve in double acting steam cylinder towards every piston stroke only thereby eating modified Rankine Cycle Power



Copyright 1999 by Marshall Brain

Locomotive Boiler side section



Legends in the sketch

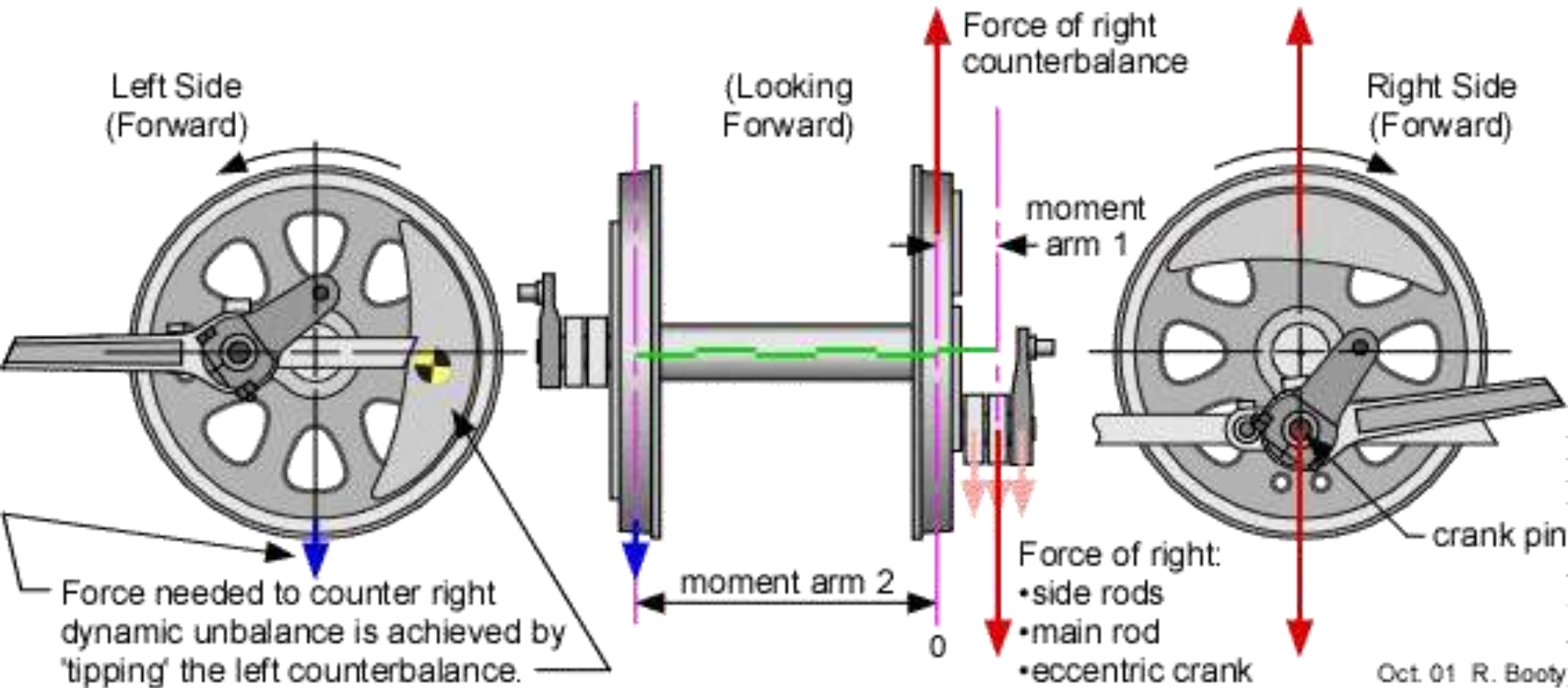
1. Water Compartment
2. Coal Bunker
3. Worm Coal Conveyor
4. Reverse
Lever (*Johnson Bar*)
5. Stoker
6. Throttle Lever
7. Water Gauge
8. Firebox
9. Crown Sheet

10. Safety Valve
11. Turbine-Generator
12. Boiler Water
13. Steam Dome
14. Throttle Valve
15. Boiler Tubes
16. Dry Pipe
17. Water Delivery Check
Valve

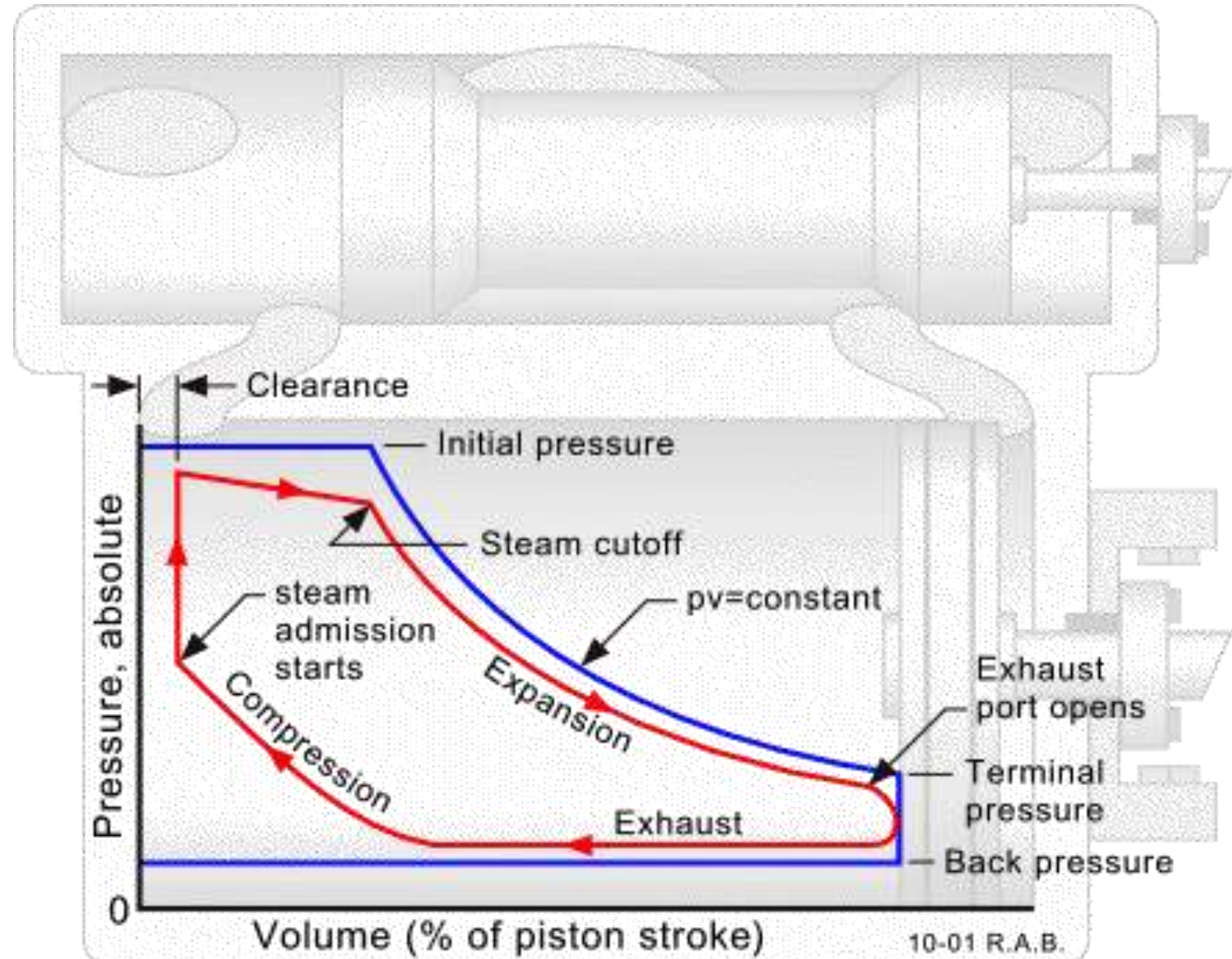
18. Sand Dome
19. Flue Tubes
20. Superheater Tubes
21. Smokebox
22. Blast Pipe
23. Steam Chest
24. Cylinder
25. Piston

26. Crosshead
27. Main Rod
28. Side Rod
29. Sand Pipe
30. Ashpan Hopper
31. Brick Arch
32. Grate
33. Injector

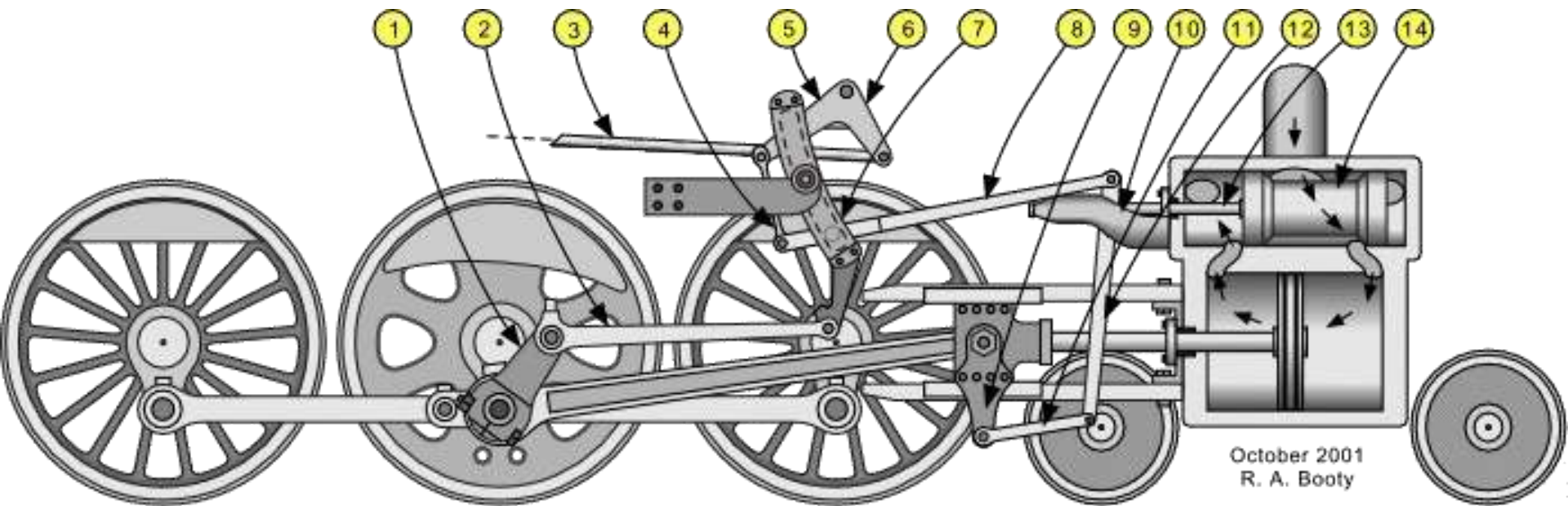
Wheelset Counterbalancing



Indicator diagram



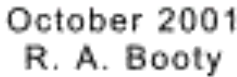
Valvegear components



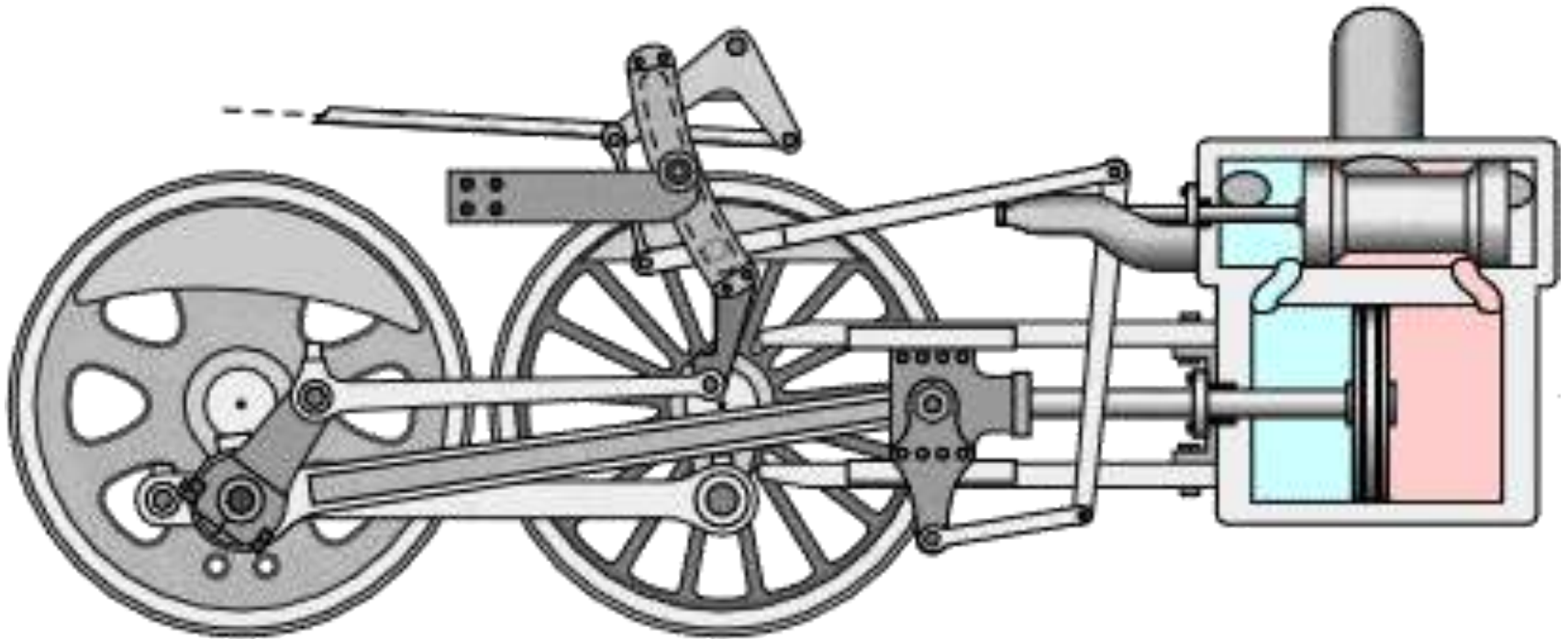
Legends in the Sketch

1. Eccentric Crank
2. Eccentric Rod
3. Reach Rod
4. Lifting Link
5. Lifting Arm
6. Reverse Arm & Shaft
7. Link (Expansion Link)
8. Radius Bar
9. Crosshead Arm
10. Valve Stem Guide
11. Union Link
12. Combination Lever
13. Valve Stem
14. Valve Spindle

┐



Walschaertz Valvegear reversing



ALCO guidelines in Valvegear adjustments

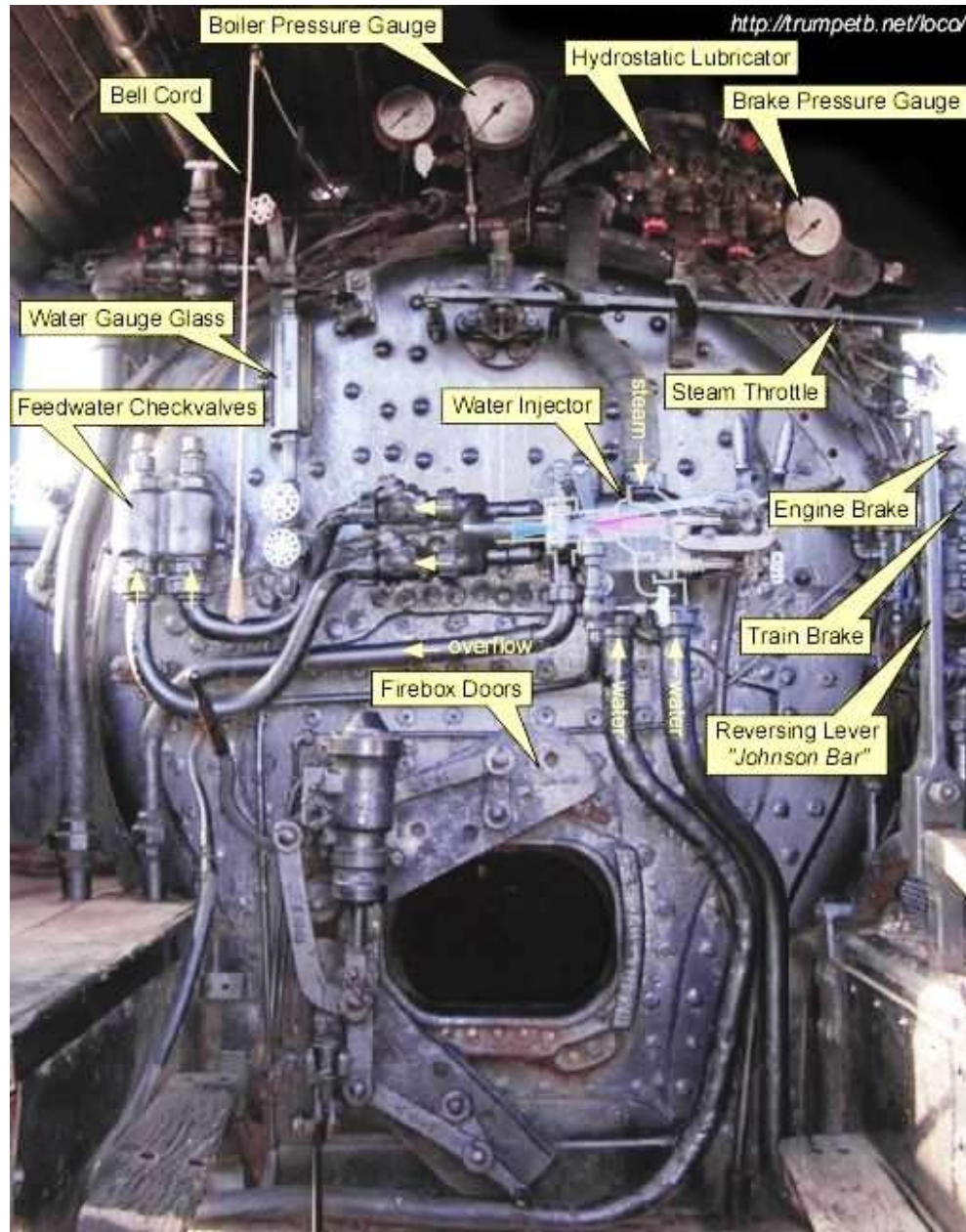
- The motion must be adjusted with the *crank* on the dead centers by lengthening or shortening the *eccentric rod* until the *link* takes such a position as to impart no motion to the *valve* when the link block is moved from its extreme forward to its extreme backward position. Before these changes in the *eccentric rod* are resorted to, the length of the *valve stem* should be examined, as it may be of advantage to plane off or line under the foot of the link support which might correct the length of both rods, or at least only one of these would need to be changed.
- The difference between the two positions of the *valve* on the forward and back centers is the lead and lap doubled and it cannot be changed except by changing the leverage relations of the *combination lever*.
- A given lead determines the lap or a given lap determines the lead, and it must be divided for both ends as desired by lengthening or shortening the *valve spindle*.

{*contd.*}

ALCO guidelines in Valvegear adjustments

- Within certain limits, this adjustment may be made by shortening or lengthening the *radius bar* but it is desirable to keep the length of this bar equal to the radius of the *link* in order to meet the requirements of the first condition.
- The lead may be increased by reducing the lap, and the cutoff point will then be slightly advanced. Increasing the lap introduces the opposite effect on the cutoff. With good judgment, these qualities may be varied to offset other irregularities inherent in transforming rotary into lineal motion.
- Slight variations may be made in the cutoff points as covered by the preceding paragraph but an independent adjustment cannot be made except by shifting the location of the suspension point which is preferably determined by a model.

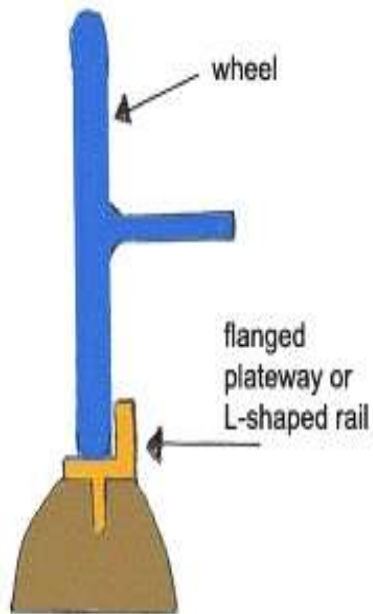
Boiler backview



Slider crank



Plate Rails & Steam engines



- **Plate Rails** were used for about 50 years till 1830.

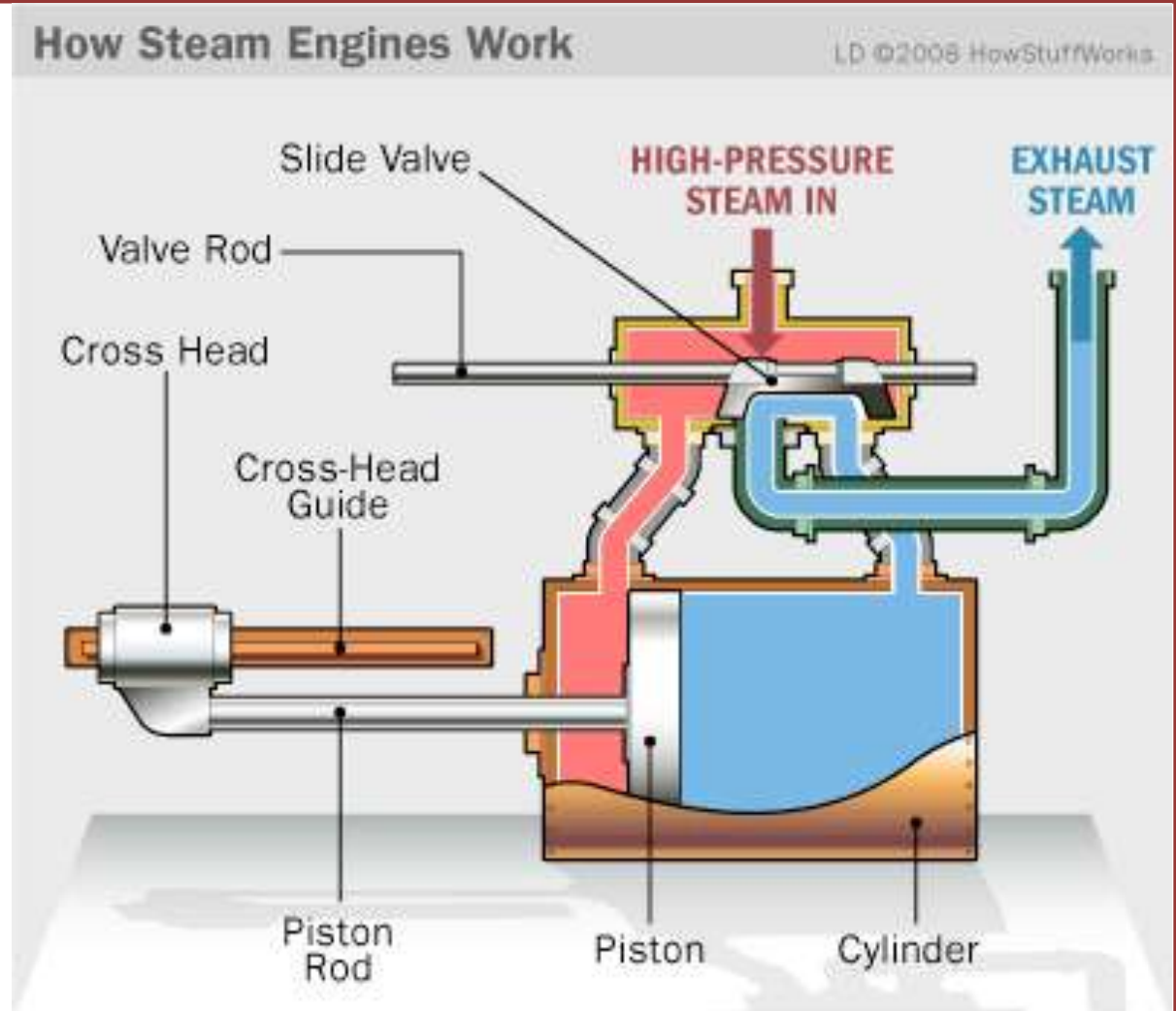
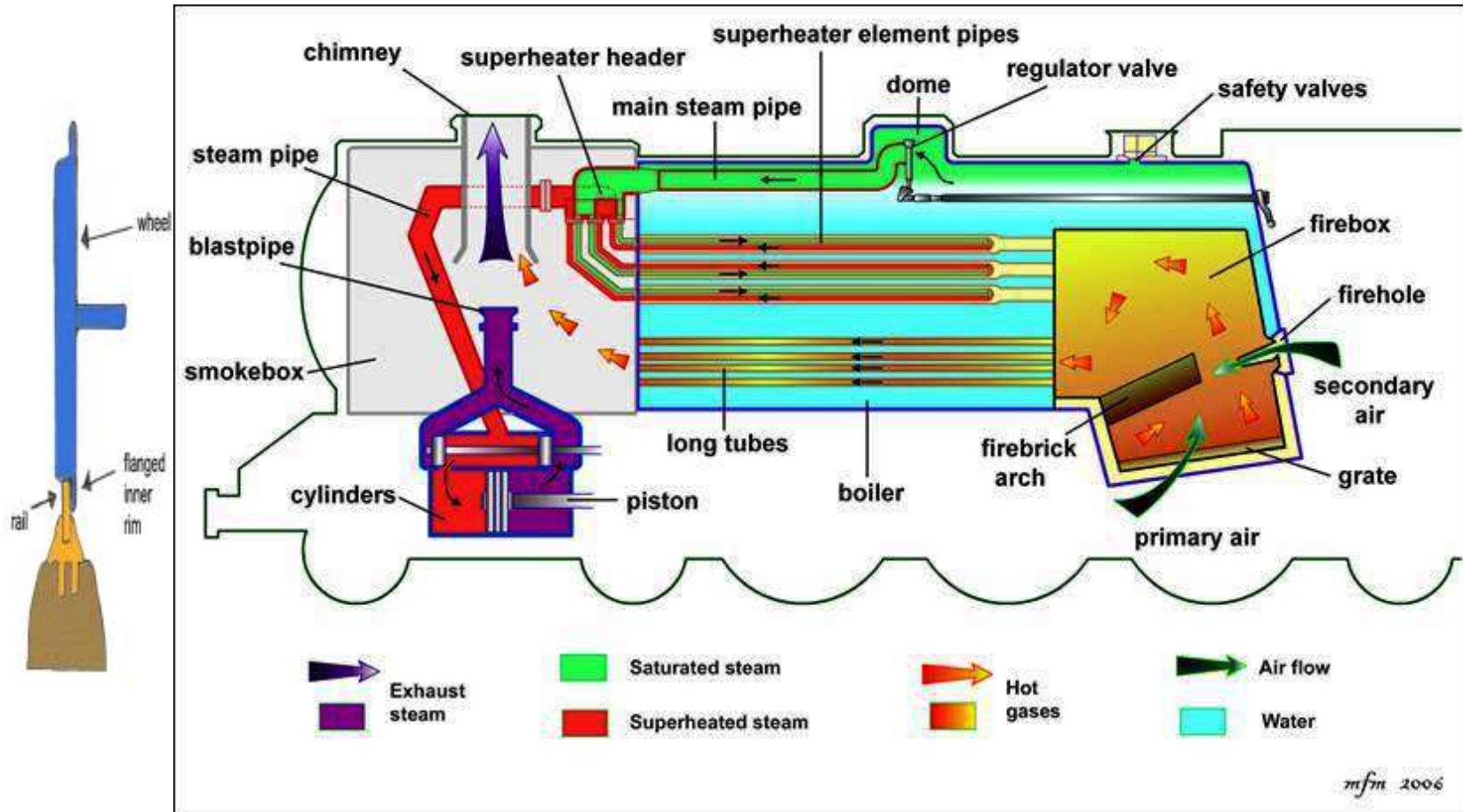


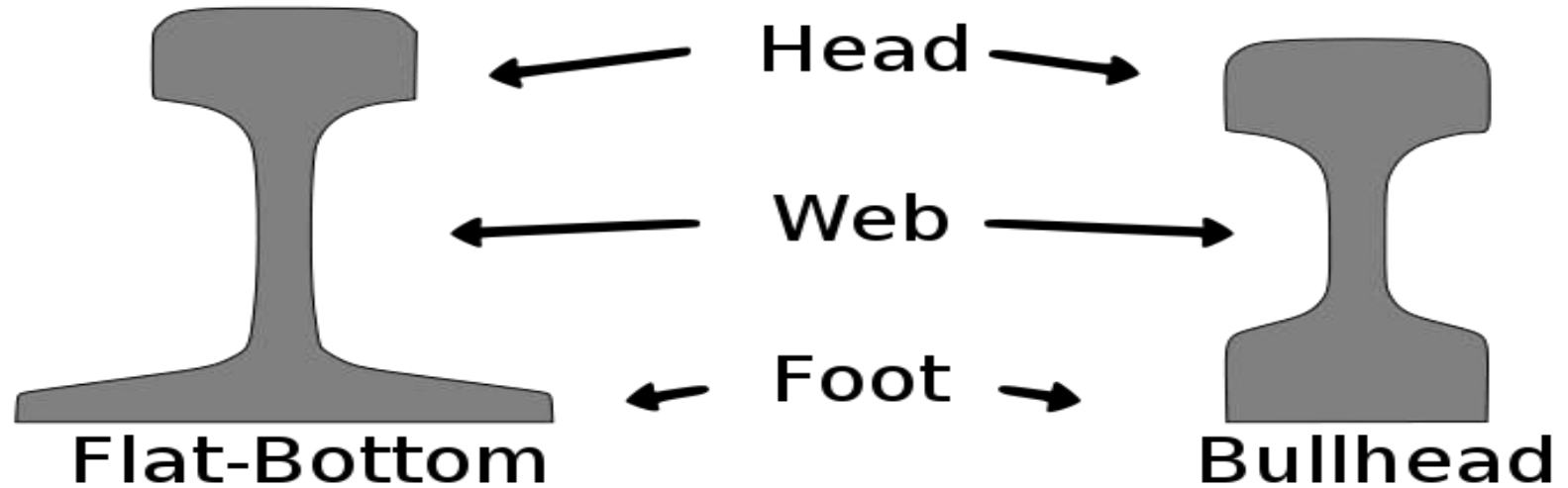
Plate Rails

Evolution of Rails & Conical Wheels



Edge Rails for Flanged Wheels
Steam Boilers

Rails/tracks

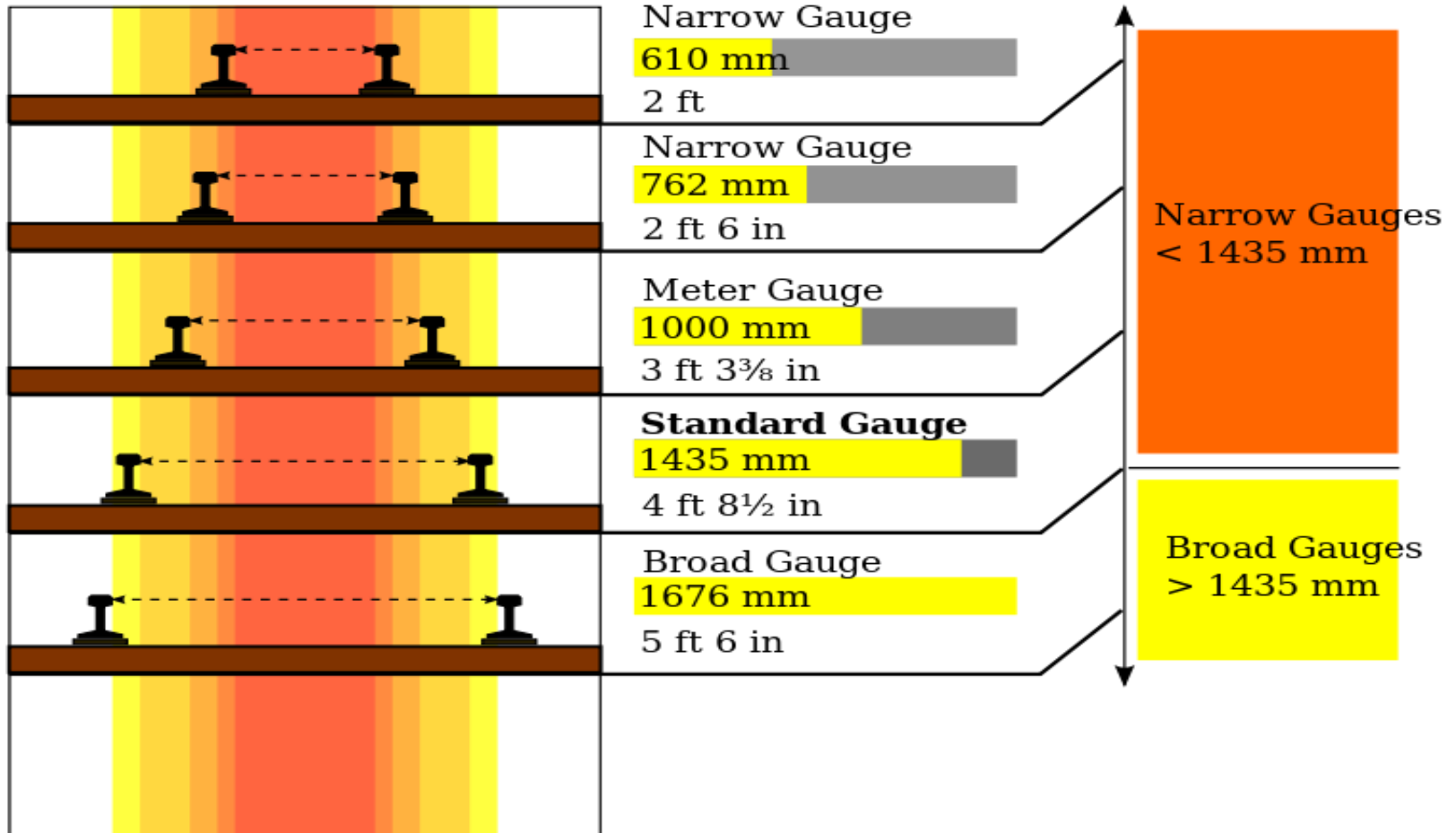


- Gauge is the Internal Distance between the 2 Rails



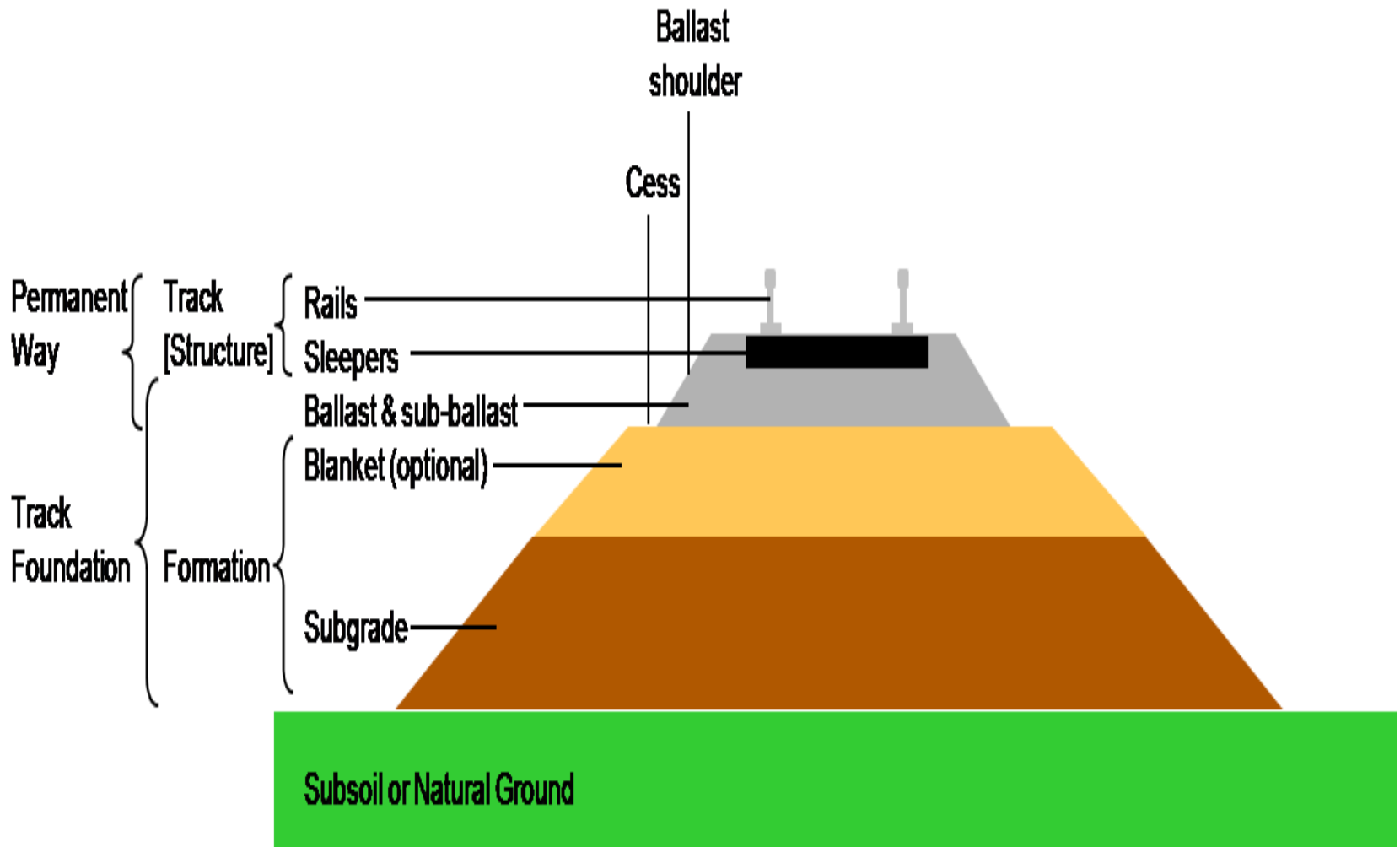
Modern Days Rails

Wide Gauge Rails



Railway Gauges

Modern Rails of Permanent Ways



Traditional Track Structure

Garratt : New South Wales - 1970



SAR : 1960 - 1993



● **ABOVE**

South Africa's Red Devil 4-8-4 represented an attempt to improve steam-locomotive potential in the face of the avowed policy to eliminate steam-traction.

● **LEFT**

Painted in Imperial Brown, to match the coaching stock, Locomotive No. A371 glints in the sun at Figtree, south-west of Bulawayo, Zimbabwe (formerly Rhodesia), in 1993.

Air Cooled MG Steam Condensing 1953 Locomotive : SAR - Details



SAR CONDENSER 25 NC CLASS 4-8-4

<i>Date</i>	1953
<i>Builder</i>	Henschel, Germany; North British, Glasgow, Scotland
<i>Client</i>	South African Railways (SAR)
<i>Gauge</i>	3 ft 6 in
<i>Driving wheels</i>	5 ft
<i>Capacity</i>	Cylinders 24 x 28 in
<i>Total weight in full working order</i>	234 tons

SAR steep gradient steam locomotive {900 tons} : Landau colliery – Transvaal



Bulawayo refreshment {en route water replenishment in 13.25 tons axleload locomotive}



Blue Nile Province : MG – 1950 built 35940 pounds tractive effort loco



Cuban Oil fired loco



Pakistan BG Railways Oil fired steam locomotive



PR {BG} Coal fired Steam locomotive



Argentine BG Oil fired loco



Czechoslovakian UIC coal fired loco



Trans Siberian Railways UIC 5 ft standard gauge locomotive



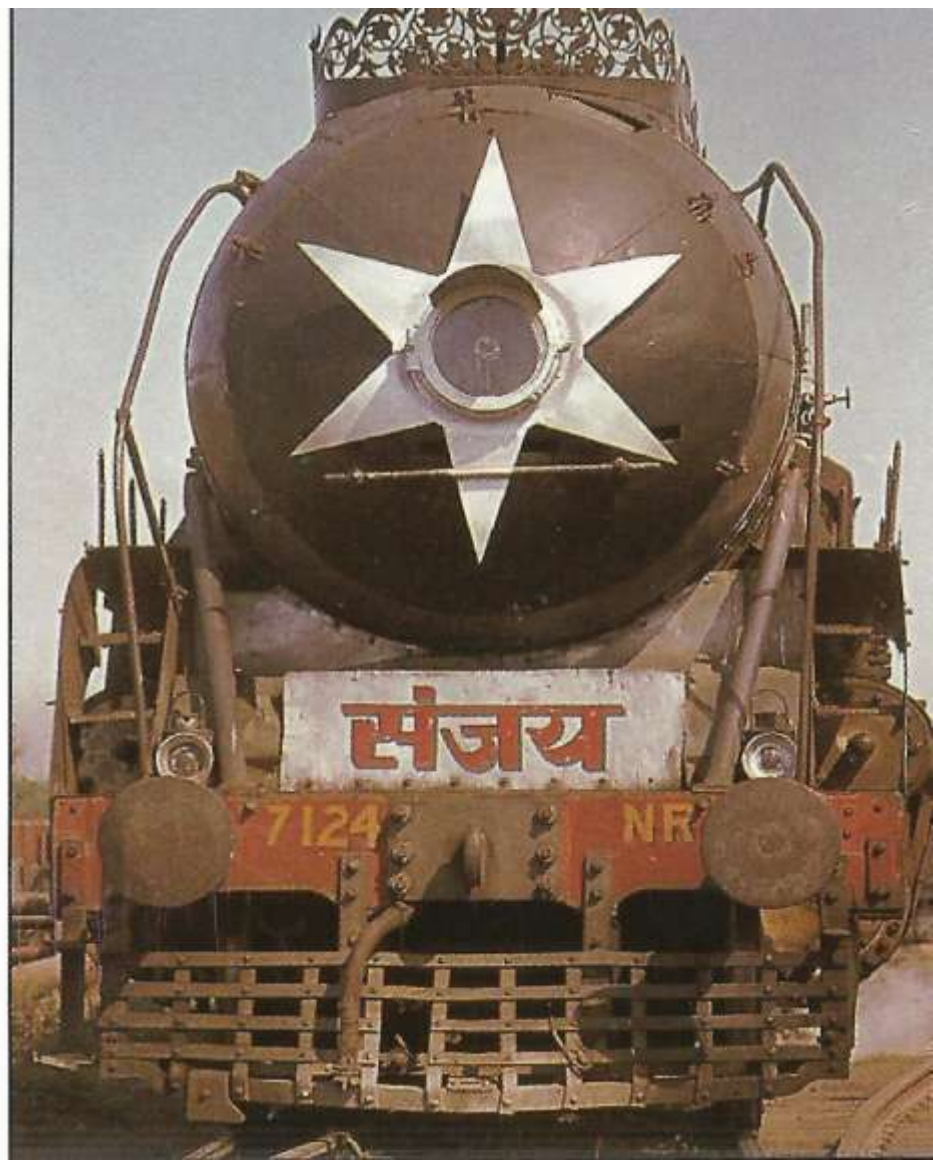
1979 Amman locomotive



1959 CLW IR BG Steam locomotive

CLASS WT 2-8-4T

<i>Date</i>	1959
<i>Builder</i>	Chittaranjan Locomotive Works, Chittaranjan, West Bengal
<i>Client</i>	Indian Railways
<i>Gauge</i>	5 ft 6 in
<i>Driving wheels</i>	Diameter 5 ft 7 in
<i>Capacity</i>	Cylinders 20 x 28 in
<i>Total weight in full working order</i>	123 tons



Rajamundry overhead water filling



1970 IR BG Steam locomotives



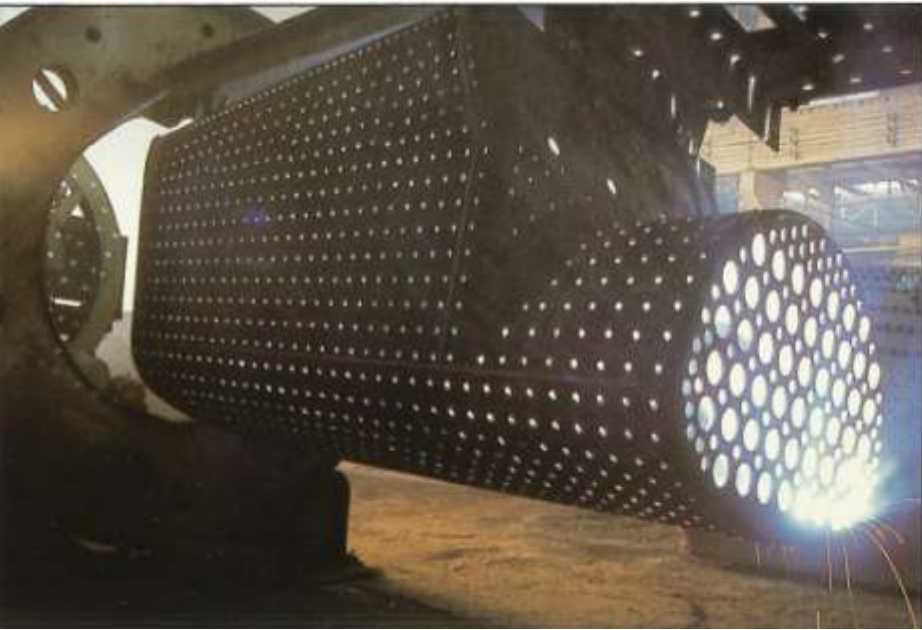
Chinese Manufacturing



Datong Locomotive Works {Shanxi}



Tangshan Locomotive Works {Hebei}



Loco wheelsets



Chinese steam loco details

(QJ) CLASS 2 - 1 0 - 2

<i>Date</i>	1957
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<i>Builder</i>	Datong & Dalian
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<i>Client</i>	China Railways
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<i>Gauge</i>	4 ft 8 ¹ / ₂ in
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<i>Driving wheels</i>	1,500 mm
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<i>Capacity</i>	2 cylinders 650 x 800 mm
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Wheel Shop



SY Class Industrial 2 8 2 loco facts

<i>Date</i>	1969
<i>Builder</i>	Tangshan Locomotive Works, Hebei Province, China
<i>Client</i>	Industrial users across China
<i>Gauge</i>	Standard
<i>Driving wheels</i>	1,370 mm
<i>Capacity</i>	2 cylinders 530 x 710 mm
<i>Total weight in full working order</i>	143 tons

SY Class Industrial 2-8-2: Fe + Steel Works, Anshan: Liaoning



Thank You